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CROP INSURANCE

LETTER

FROM

SECRETARY OF AGRICULTURE

TRANSMITTING

IN RESPONSE TO SENATE RESOLUTION No. 51, A REPORT ON CROP INSURANCE: RISKS, LOSSES, AND PRINCIPLES OF PROTECTION

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DEPARTMENT OF AGRICULTURE,
Washington, December 22, 1928.

Mr. EDWARD P. THAYER,
Secretary of the Senate.

DEAR MR. THAYER: This resolution, official notice of which was received under date of March 6, 1928, and acknowledged by me under date of March 15, reads as follows:

> *Resolved*, That the Secretary of Agriculture is hereby requested to report to the Senate at the beginning of the second regular session of the Seventieth Congress his views as to whether the insurance of the farmer by the Federal Government against droughts, floods, storms, and other hazards beyond his control would be consistent with sound governmental and economic policy; and if so, under what conditions such insurance should be issued.

I assume, from the hazards mentioned in the resolution, that the insurance in question pertains mainly to farm crops. It is not possible on the basis of existing information to say whether such insurance is practicable or under what conditions it should be issued. Therefore, the first function of the Government with respect to insurance of this character is, in my opinion, to secure the necessary factual basis. This, however, would call for more extensive research than the department has been in a position to make. The results of such research should be made available to the general public, including existing insurance agencies as well as any new institutions that may be created, by private parties or by organizations of producers, to provide crop insurance.

The need for minimizing risks in agriculture due to unavoidable hazards is, it seems to me, self-evident. This need varies for different sections of the country in accordance with climatic and other conditions, and with the degree of diversification practiced. In general, it may be said that diversification in respect to marketable crops is least practiced and for the present least practicable in the sections where climatic conditions are most uncertain, as for example in the Spring Wheat Belt, the western part of the Corn Belt, and the western part of the Cotton Belt, where the drought hazard is pronounced and failures from this cause are relatively frequent. Certain fruit and truck sections, where climatic or soil conditions have led to specialization in production, are also in peculiar need of crop insurance.

The probability of general crop failures is smaller in sections having less specialized agriculture, but no section is without serious crop hazards and no farmer, regardless of where he operates, has any real assurance at the time of planting that his capital and current labor invested in the crop may not be a total loss. Only by having his crops insured for an amount representing at least a substantial part of his investment therein can the farmer be safeguarded against the possibility of serious loss.

The need for crop insurance also varies with the economic position attained by the farmer. The well-established farmer, without debt on his property and with a reserve in cash or in other convenient form, may be in position to bear the loss of one year's investment in his crops without serious hardship. On the other hand, the beginner in farming and every farmer with heavy interest charges on outstanding indebtedness assumes serious chances of financial embarrassment through his unprotected investments in a single season's crops. Every year thousands of such farmers are economically ruined or seriously crippled in their future production programs by reason of unexpected failure or destruction of their growing crops.

While it must be admitted that the farmer's need for crop insurance is real, his recognition of this need, to the extent of being willing to purchase crop insurance if available on equitable terms, is far less certain. It may be true, as in the case of other forms of insurance protection, that those in need of crop insurance must be educated to its use before they avail themselves of it. Few individuals, for instance, provide themselves with life-insurance protection except upon being solicited and having its benefits urged upon them. Any rapid or extensive development of crop insurance will no doubt, therefore, require a considerable amount of educational work coupled with efficient solicitation. The only alternative would seem to be compulsory insurance which, even if found constitutional, would quite certainly be opposed by a large majority of American farmers.

Attempts have been made by private insurance organizations to develop forms of crop insurance, and two or three such attempts are now in progress. But the two most outstanding efforts have proved decidedly discouraging. One of these major attempts was launched in the spring-wheat States of North Dakota, South Dakota, and Montana in 1917. The plan was essentially that of insuring a minimum yield per acre without guaranteeing the price of the product.

An even more ambitious effort at making crop insurance generally available was made in 1920. The plan in this case was to insure a minimum income per acre corresponding to a conservative estimate of the farmer's investment in his crop, and, therefore, the insurance in effect covered price as well as yield.

The first of these major attempts failed apparently from a combination of two causes, namely, a severe drought which covered a major part of the spring-wheat belt to which operations were confined, and failure on the part of the companies to safeguard themselves against the assumption of risks after the crops were already practically lost. The 1920 attempt which, as already indicated, covered price as well as yield, proved a highly costly experiment by reason of the well nigh unprecedented drop in the price of farm products which occurred between the time of writing the insurance in the winter and early spring and the time of harvest in the fall. Neither of these attempts prove at all conclusively that some form of crop insurance can not be successfully written by private companies.

The two major experiments with crop insurance, above mentioned, are outlined more fully in Department Bulletin 1043, three copies of which are inclosed. A large amount of additional information on crop insurance is available in Hearings Before a Selected Committee on Investigation of Crop Insurance, United States Senate, Sixty-seventh Congress, First Session.

Since 1921 the activities of private insurance companies in the field of crop insurance, other than insurance against hail, which is quite generally available, have been confined largely to insurance against frost and freeze on citrus crops in Florida and in California and on sugar cane in Louisiana, with a limited amount of broader or all-risk insurance on other crops and particularly on fruit and truck crops in selected areas. This insurance quite generally has covered advances made to the grower by loan agencies or by city commission men. The frost and freeze insurance just mentioned has been in large measure discontinued, and no outstanding attempt to make crop insurance generally available to the American farmer has been made since 1920.

There is little doubt that the insurance of farm crops by a corporation with initial capital advanced by the Government would involve pronounced difficulties, some of which probably would be somewhat greater than in the case of strictly private insurance companies. In the first place, an agency capitalized or initially financed by the Federal Government very likely would be expected, from the beginning of its activities, to offer its facilities to essentially all important groups of farmers in all sections of the country. If this assumption is correct, forms of insurance and rates of premium would be demanded for all important crops and for all States and reasonable subdivisions of States in advance of practical experience in the conduct of the business. Moreover, complaints from localities where the insurance premiums were high by reason of severe crop hazards would likely give rise to delicate problems for a public agency engaged in this type of insurance. A uniform-rate plan, or even an approach to it, would, in the case of crop insurance, result in an unjustifiable discrimination against all better farming sections in behalf of the less-favored sections, and would unduly encourage the bringing of marginal, or what is now submarginal, land into competition with existing farms.

Similarly, the refusal of insurance to individuals who because of records of shiftlessness, or for other reasons, should be excluded from insurance would no doubt occasion serious complaints and insistent demand for a more lenient policy. Nevertheless, the very nature of crop insurance requires strong and ample safeguards against what is generally termed the moral hazard. The thing insured is not tangible goods already in existence but rather goods in prospect to be developed under the care of the insured.

The risks in agriculture should be obvious to all. In no industry of which I am aware is the owner or proprietor called upon to carry, unaided by insurance, such risks as are involved in crop production. While the difficulties of crop insurance are many, it should be possible to surmount them to a degree that would permit the application of insurance principles to the farmer's risks due to the hazards indicated in the resolution. As noted in the beginning of this letter, it seems to me that the first function of the Federal Government with respect to crop insurance is to secure the necessary information. If a sound actuarial basis for such insurance be found, if private initiative should nevertheless fail to meet this need, and if there should be reasonable grounds for assuming that farmers would readily avail themselves of Federal crop insurance on a basis that would not unduly imperil the safety of public funds involved, then and only then, I believe, would

it be consistent with sound governmental and economic policy for the Federal Government to provide insurance against these hazards through a corporation initially financed by the Government.

Sincerely yours,

W. M. JARDINE, *Secretary.*

Submitted to the Bureau of the Budget, pursuant to Circular No. 49, of that bureau, and returned to the Department of Agriculture on December 19, 1928, with the advice that the foregoing report is not in conflict with the financial program of the President.

This bulletin, which is referred to in the Secretary's letter and which was originally published in January, 1922, as Department Bulletin No. 1043, is reprinted by reason of its direct bearing on the questions involved in Senate Resolution No. 51.

CROP INSURANCE: RISKS, LOSSES, AND PRINCIPLES OF PROTECTION

By V. N. VALGREN, *Associate Agricultural Economist*

THE FARMER'S "INDEPENDENCE"

The farmer is frequently spoken of as the most independent member of organized society. Using the word "independent" in its social significance, this characterization is essentially true. Certainly the land-owning farmer is less directly dependent than those who follow commercial or professional pursuits upon the good will of his fellow men and under less obligation to cater to their whims or prejudices. But though the farmer enjoys a comparatively high degree of independence in his social and business relations, his economic status, to an unusual degree, is directly dependent upon nature.

The factory, the mill, the store, or the business of the professional man may continue, for a time at least, but little disturbed by adverse weather conditions or other natural agencies that endanger farm crops. Only when these conditions or agencies cause the failure of crops over wide areas are commercial and professional men affected severely. Assuming, however, that the farmer brings to his work reasonable effort and good judgment, favorable action of natural forces and agencies means a large harvest, while adverse action by one or more of them many nullify his best efforts. Excessive heat or rain may ruin his planted fields, his gardens, or his orchards, as may also the lack of heat or the coming of drought. His growing grain or fruit may be injured by plant diseases, devoured by insect or animal pests, or severely damaged by windstorms, frost, or hail.

MEANING OF "LOSS" OR "DAMAGE" IN CONNECTION WITH GROWING CROPS

Before attempting to make any statement concerning the importance or extent of loss or damage to farmers resulting from adverse natural conditions or agencies, the meaning of the words "loss" or "damage" when used in connection with crops must be determined. One or two simple illustrations will assist in giving these terms a more definite meaning than the one often attached to them.

Assume, for example, that with ideal climatic conditions and in the absence of all loss-producing agencies, A, B, and C, farmers in different sections of the country, can produce, respectively, 40 bushels

of wheat, 100 bushels of corn, and 800 pounds of lint cotton an acre. Each man has at some time produced the exceptionally large yields indicated. Because the conditions are not ideal during a given season, A actually harvests only 20 bushels of wheat an acre, B only 55 bushels of corn, and C only 350 pounds of cotton. Taking into consideration the loss due to damage to crops from all causes or combinations of causes, these three farmers, in a certain sense at least, may claim losses of 20 bushels of wheat, 45 bushels of corn, and 450 pounds of cotton an acre, respectively. They failed by the amounts indicated to obtain the maximum crops that would have resulted from the expenditure of their labor and capital had not weather conditions and other natural agencies been to some extent adverse.

As the natural hazards to crops are exceptionally high in certain types of farming, such as wheat production in the semiarid West, the next illustration may very properly be based on this type of farming. Let it be assumed that farmers X, Y, and Z are engaged during a given year in producing wheat by dry-farming methods in three semiarid regions of the West, and that the average yield of wheat in each of these regions for the last 20 years has been 8 bushels an acre. Let it be assumed also that this average yield has, at the price received, given returns covering all proper charges against the production of an acre of wheat under the methods of tillage followed by these men. On each of the farms in question 35-bushel yields have been harvested, Y having reaped a 35-bushel crop a year ago.

In the territory where X operates, average conditions prevail throughout the year in question. X grows and actually reaps an 8-bushel crop. In Y's territory the season proves extremely adverse, a late spring frost followed by drought causing his crop to be a total failure. Finally, in the territory where Z is farming, climatic and other conditions prove highly favorable during the greater part of the season Until within two weeks of harvest time, Z figures that he has a 35-bushel crop in prospect. At that time, however, a hailstorm passes over his farm and destroys 60 per cent of his crop, resulting in an actual yield of 14 bushels an acre instead of 35 bushels.

Limiting consideration to the returns for the single year and speaking this time first in terms of actual income rather than prospective income, farmer X, who grew and harvested an 8-bushel crop, had neither a profit nor a loss. He reaped an amount which at the price received was equivalent to his entire costs chargeable to the season's crop. On the other hand, farmer Y, who, because of frost and drought reaped no harvest whatever, suffered a loss equivalent to his entire expenditure of labor and capital chargeable to the year's operations. Farmer Z, with his 14-bushel yield, in spite of the damage to his crop by hail, realized a profit.

If, however, the matter is considered from the point of view not of actual income but of prospective yield and income, as was done in the first illustration, the situation changes. Had it not been for drought, excessive heat, untimely frost, hail, or some other cause or combination of causes, X, Y, and Z would each have reaped a 35-bushel yield. In a certain sense, therefore, all may claim to have suffered loss. This becomes more apparent in the case of farmer Z, who had in immediate prospect a 35-bushel yield when he suddenly suffered a 60 per cent damage by hail, in consequence of which he

claimed a loss of 21 bushels an acre. He actually reaped a harvest of 14 bushels an acre, while his cost of production was only the equivalent of 8 bushels an acre. Nevertheless, if Z had carried hail insurance on his crop he would have been entitled to indemnity, under the prevailing plan of settlement, equivalent to 60 per cent of his insurance an acre. It must be conceded, therefore, that Z suffered a recognized form of loss, even though the loss related to wheat in prospect rather than to wheat already in existence and in spite of the fact that his hail-damaged crop yielded him a material profit over and above his cost of production. The fact that the loss or damage suffered by Z on his crop was sudden and spectacular does not make it materially different from the losses or damages suffered by X and Y. In each case it was wheat in prospect and not wheat in actual existence that was lost. At the time of planting the prospects of a perfect yield may have been equally good for each of the three men. The prospects of X were early reduced by certain natural causes; those of Y were entirely eliminated also in the early part of the season; while those of Z continued good until near harvest time, when they were suddenly reduced.

From these illustrations it becomes apparent that the word "loss" in connection with crops may have either of two different meanings. The kind of loss suffered by Z when his prospective 35-bushel wheat crop was reduced by a hailstorm to a 14-bushel crop, as well as the less spectacular but more severe loss which caused the prospects of X to shrink from 35 to 8 bushels an acre, is perhaps best termed "crop damage" by way of distinguishing it from the kind of loss suffered by Y, which was not only crop damage or a diminution in prospective yield, but a "financial loss" on the season's operations.

Adhering to this terminology, it may be said that X and Z suffered crop damage on their wheat, which, however, was not sufficiently severe to prevent X from breaking even, or Z from making a profit on the year's operations. Y, on the other hand, suffered crop damage which resulted in a financial loss equal to his entire expenditures in connection with the crop which failed to yield a harvest. Similarly A, B, and C, in the first illustration, with their harvests of 20 bushels of wheat, 55 bushels of corn, and 350 pounds of cotton, respectively, suffered crop damage, although each may have been able to show a financial profit instead of a financial loss on his year's operations.

Even after this attempt at clarification, one of the terms, "crop damage," retains a vagueness which it seems impossible entirely to remove. The idea of crop damage set forth in the preceding paragraphs may be said to be faulty in that it assumes that the best crop yet harvested was a perfect or no-damage crop, whereas it may well be questioned if on any farm such a crop has yet been reaped. It must be further conceded that it would be impracticable to arrive at any figures representing the crop damage for a larger area or for the country as a whole by using the term as outlined, since it would be impossible to take into consideration the maximum yield on each individual farm.

In order to obviate these difficulties and to make it possible to work out approximate figures for the amount of crop damage from various causes, the United States Department of Agriculture has arbitrarily assumed that a crop exceeding by 10 per cent the normal yield is a perfect or no-damage crop for the territory in question. The normal

yield may, in turn, be defined as the yield that the crop reporter has in mind as one which in good years actually occurs over extended areas, and in percentages of which he reports crop prospects as well as crop damages from the different causes. The raising of the normal yield by 10 per cent in order to determine the no-damage yield is an attempt to make suitable allowance for the fact that the yield which the crop reporter, as the result of experience and observation, has in mind as a normal yield for his locality is not strictly a perfect or no-damage yield. The difference between a perfect or no-damage yield and the actual yield is the measure of total crop damage.

QUANTITATIVE IMPORTANCE OF ANNUAL DAMAGE TO FARM CROPS

About 12 years ago the United States Department of Agriculture began to require of its thousands of crop reporters in all parts of the United States estimates of the percentage of damage caused to leading crops from specified causes. The crops covered are corn, wheat, oats, barley, flaxseed, rice, potatoes, tobacco, hay, and cotton. The percentage of damage from the various causes and the quantitative damage, calculated by applying the standard for a perfect or no-damage crop indicated above, are given in condensed form in Tables 1 and 2, respectively. Table 3 gives value figures obtained by applying to the quantitative figures the price per unit prevailing during each year. While all three tables give damage by the same specified causes for each of the crops enumerated, Tables 1 and 2 give in percentages and in quantitative units, respectively, average annual damage during the decade, 1909–1918, by geographic divisions, as well as for the country as a whole. Table 3, on the other hand, expresses the damage during each year from 1909 to 1919, inclusive, in terms of dollars, all the figures in this table applying to the country as a whole.

The geographic divisions here used are designated as North Atlantic, South Atlantic, East North Central, West North Central, South Central, and Far West (fig. 1).

TABLE 1.—*Average annual crop damage from specified causes, in percentage of normal yield, by geographic divisions, for decade 1909–1918* [1]

Crop and geographic division	Total loss	Adverse weather conditions								Plant diseases	Insect pests	Animal pests	Other and unknown [3]
		Deficient moisture	Excessive moisture	Floods	Frost	Hail	Hot winds	Storms	Other climatic [2]				
Corn:													
North Atlantic	24.14	9.58	4.55	0.18	3.57	0.36	0.20	0.61	0.70	0.16	2.23	0.17	1.83
South Atlantic	21.07	9.62	4.31	1.24	.63	.33	.39	.64	.24	.27	2.28	.15	.97
East North Central	28.73	11.04	4.79	.75	4.65	.25	1.43	.64	.43	.15	2.88	.10	1.62
West North Central	36.38	19.22	3.64	.68	3.64	.69	3.27	.30	.51	.14	2.77	.23	1.29
South Central	34.62	20.98	3.31	1.28	.60	.34	2.80	.73	.34	.37	2.76	.15	.96
Far West	29.89	17.51	.73	.29	3.43	1.12	.72	.12	.50	.49	2.94	.96	1.08
Total	31.99	16.19	4.00	.88	2.85	.44	2.29	.52	.44	.22	2.70	.17	1.29

[1] The statistical data contained in this table and in Tables 2 and 3 were gathered, tabulated, and computed by the Bureau of Crop Estimates, which has recently been combined with the Bureau of Markets, as the Bureau of Markets and Crop Estimates.

[2] Including winterkill.

[3] Including defective seed.

TABLE 1.—*Average annual crop damage from specified causes, in percentage of normal yield, by geographic divisions, for decade 1909–1918*—Continued

Crop and geographic division	Total loss	Adverse weather conditions								Plant diseases	Insect pests	Animal pests	Other and unknown
		Deficient moisture	Excessive moisture	Floods	Frost	Hail	Hot winds	Storms	Other climatic				
Wheat:													
North Atlantic	16.81	3.37	1.36	0.14	1.29	0.24	0.15	0.16	5.18	0.47	3.15	0.03	1.27
South Atlantic	17.61	4.64	2.21	.39	.96	.47	.24	.27	3.12	2.23	1.54	.06	1.48
East North Central	23.06	3.59	2.28	.38	.82	.20	.44	.16	9.51	.77	3.88	.01	1.02
West North Central	33.04	14.59	2.33	.35	.48	1.49	2.99	.30	3.79	3.92	2.02	.11	.67
South Central	32.17	18.09	2.63	.44	.33	.72	1.60	.19	2.71	1.48	2.67	.09	1.22
Far West	23.48	12.96	.77	.24	1.32	1.22	1.42	.29	1.81	1.21	.62	.82	.80
Total	28.77	12.38	2.03	.33	.70	1.10	2.02	.26	4.13	2.65	2.12	.19	.86
Oats:													
North Atlantic	17.47	7.94	3.85	.15	.17	.32	.43	.49	.54	1.70	.54	.03	1.31
South Atlantic	23.82	9.50	2.10	.54	.79	.17	.21	.21	6.10	1.89	.41	.06	1.84
East North Central	20.66	10.76	3.38	.35	.16	.26	1.42	.57	.39	1.42	.82	.01	1.12
West North Central	26.76	15.05	2.43	.25	.40	1.17	2.83	.38	.40	2.04	.95	.06	.80
South Central	32.53	19.61	2.83	.58	.49	.47	1.18	.32	2.07	1.73	1.49	.06	1.70
Far West	22.68	13.72	1.00	.11	1.15	1.60	1.08	.30	.59	.90	.63	.68	.92
Total	24.52	13.44	2.73	.31	.38	.77	1.90	.43	.80	1.73	.89	.08	1.06
Barley:													
East North Central	15.35	6.50	2.75	.16	.31	.30	2.17	.52	.34	.66	.32	.01	1.31
West North Central	33.90	20.12	1.76	.16	.64	1.81	4.19	.42	.38	2.28	.94	.16	1.04
Far West	20.48	13.60	1.25	.10	.97	.44	.94	.15	.60	.39	.37	.73	.94
Total	28.65	17.06	1.78	.14	.68	1.32	3.17	.36	.43	1.65	.74	.27	1.05
Flaxseed: Total	36.44	21.06	1.25	.14	3.97	1.72	3.04	.22	.39	2.19	.95	.09	1.42
Rice:													
South Central	19.77	7.20	3.24	1.52	.25	.02	.36	2.01	.23	1.22	.79	.24	2.69
California	8.43	1.34	.77	------	.42	------	1.43	.10	.28	------	------	.67	3.42
Total	19.04	6.67	3.14	1.47	.24	.02	.43	1.85	.23	1.18	.76	.29	2.76
Potatoes:													
North Atlantic	29.46	10.23	4.21	.12	1.36	.05	.40	.04	.48	8.02	2.98	.03	1.54
South Atlantic	28.28	15.51	1.96	.34	.71	.14	.38	.04	.31	2.86	3.68	.08	2.27
East North Central	31.08	14.53	3.78	.29	2.19	.04	.83	.04	.47	4.31	3.15	.01	1.44
West North Central	33.35	20.00	3.01	.33	.96	.30	1.28	.04	.49	1.96	3.79	.06	1.13
South Central	32.66	18.62	2.35	.35	.91	.17	.65	.06	.41	1.11	5.58	.05	2.40
Far West	23.75	11.15	.62	.16	2.77	.26	.57	.06	.48	3.62	1.31	.42	2.33
Total	30.12	14.55	3.08	.25	1.57	.14	.73	.04	.45	4.35	3.23	.08	1.65
Tobacco:													
North Atlantic	15.05	6.34	1.29	.18	1.79	2.17	.07	.55	.46	.22	1.12	.01	.85
South Atlantic	21.38	8.75	4.01	.66	.41	.75	.15	.51	.40	.54	3.54	.01	1.65
East North Central	19.26	6.72	3.16	.37	3.33	1.13	.21	.36	.34	.45	1.72	(1)	1.47
South Central	21.33	9.84	4.03	.81	.65	.44	.25	.13	.42	.28	2.35	.01	2.12
Total	20.50	8.72	3.65	.64	1.02	.81	.19	.34	.39	.40	2.59	.01	1.74
Hay:													
North Atlantic	16.50	10.08	1.50	.09	.92	.05	.25	.12	1.53	.09	.45	.01	1.41
South Atlantic	21.27	14.28	2.01	.66	.38	.15	.32	.17	1.06	.13	.30	.04	1.77
East North Central	19.01	10.89	1.99	.27	.71	.04	.53	.14	2.27	.09	.57	.01	1.50
West North Central	24.89	19.11	1.52	.36	.20	.17	1.03	.09	1.30	.05	.40	.03	.63
South Central	22.10	14.63	2.61	.61	.19	.07	.72	.21	.79	.13	.23	.02	1.89
Far West	18.91	11.88	1.33	.25	1.16	.25	.42	.22	.77	.17	1.00	.46	1.00
Total	20.35	13.44	1.74	.31	.62	.11	.58	.15	1.45	.10	.52	.08	1.25
Cotton:													
South Atlantic	27.09	6.60	6.75	1.10	1.99	.48	.99	.60	.77	3.03	2.85	(1)	1.93
South Central	38.83	14.53	3.42	1.03	1.05	.48	1.75	.75	.57	1.61	12.35	.03	1.26
Total	35.49	12.29	4.34	1.05	1.32	.48	1.56	.71	.60	2.00	9.67	.02	1.45

[1] Less than 0.005 of 1 per cent.

The purpose of Table 1 is to bring out the relative degree of severity of the different hazards, or causes of damage, with reference to each of the crops enumerated for the country as a whole as well as for the various geographic divisions. Thus, in the case of corn, deficient moisture represented the most severe hazard during the 10-year period, not only for the country as a whole, but also for each of the geographic divisions. Excessive moisture represented the second most severe hazard for the country and for four of the six geographic divisions. Frost was the third most severe hazard, insect pests the fourth, and hot winds the fifth, considering the country as a whole. None of the other specified causes represented as much as 1 per cent of damage for the entire country, although the damage or loss from floods exceeded this amount in the South Atlantic and South Central States, and hail damage was more than 1 per cent of the crop damage in the far Western States.

The purpose of Table 2 is to show quantitative damages on a plan similar to that by which damages are given on a percentage basis in Table 1. The figures in Table 2, therefore, represent not only the relative severity of the hazards or causes of damage in each, case but also the importance, from the point of view of acreage or volume, of the given crop, in the division or in the entire country as the case may be. This explains why some causes of loss appear relatively important for given crops in certain divisions in Table 1 and relatively unimportant for the same crop in the same divisions in Table 2. According to Table 1, for example, an average of 1.12 per cent of the corn crop was lost annually in the far western division through the occurrence of hail, which was a higher percentage of hail damage than occurred to this crop in any other division. But according to Table 2, owing to the relative unimportance of the corn crop in this division, the total hail damage was only 300,000 bushels, or less than it was in any other division.

TABLE 2.—*Average annual crop damage from specified causes, in bushels, pounds, or tons, by geographic divisions, for decade 1909–1918*

[In millions of bushels or pounds, and thousands of tons]

Crop and geographic division	Total loss	Adverse weather conditions								Plant diseases	Insect pests	Animal pests	Other and unknown [2]
		Deficient moisture	Excessive moisture	Floods	Frost	Hail	Hot winds	Storms	Other climatic [1]				
Corn (bushels):													
North Atlantic	31.9	12.3	6.3	0.2	4.9	0.5	0.3	0.8	0.9	0.2	2.9	0.2	2.4
South Atlantic	87.2	39.8	17.5	5.1	2.8	1.4	1.6	2.7	1.1	1.1	9.5	0.6	4.0
East North Central	317.4	120.8	53.0	8.3	53.0	2.8	15.5	7.0	4.8	1.7	31.6	1.1	17.8
West North Central	588.0	310.8	57.1	10.8	61.4	11.2	52.3	4.7	8.3	2.3	44.5	3.8	20.8
South Central	313.7	189.0	31.7	11.5	5.0	2.8	24.9	6.7	3.4	3.5	24.6	1.4	9.2
Far West	7.3	4.3	.2	.1	.8	.3	.2	(3)	.1	.1	.7	.2	.3
Total	1,345.6	677.0	165.8	36.1	127.9	19.0	94.8	22.0	18.5	8.9	113.8	7.3	54.5

[1] Including winterkill. [2] Including defective seed. [3] Less than 50,000 bushels.

TABLE 2.—*Average annual crop damage from specified causes, in bushels, pounds, or tons, by geographic divisions, for decade 1909–1918*—Continued

Crop and geographic division	Total loss	Adverse weather conditions								Plant diseases	Insect pests	Animal pests	Other and unknown
		Deficient moisture	Excessive moisture	Floods	Frost	Hail	Hot winds	Storms	Other climatic				
Wheat (bushels):													
North Atlantic	6.9	1.3	0.6	0.1	0.5	0.1	0.1	0.1	2.2	0.2	1.3	(3)	0.4
South Atlantic	8.9	2.3	1.1	.2	.4	.3	.1	.1	1.8	1.1	.8	(3)	.7
East North Central	35.1	6.1	3.6	.6	1.3	.3	.8	.3	12.7	1.2	6.5	(3)	1.7
West North Central	179.3	77.4	13.9	2.0	2.6	8.3	16.5	1.7	18.5	22.5	11.6	.6	3.7
South Central	27.5	14.5	2.7	.4	.2	.7	1.2	.2	2.6	1.4	2.5	.1	1.0
Far West	43.5	24.5	1.3	.4	2.3	2.2	2.7	.5	3.3	2.2	1.2	1.5	1.4
Total	301.2	126.2	23.1	3.8	7.4	11.9	21.4	2.8	41.0	28.6	23.8	2.1	9.1
Oats (bushels):													
North Atlantic	19.9	9.1	4.4	.2	.2	.3	.5	.6	.6	1.9	.6	(3)	1.5
South Atlantic	11.5	4.6	1.0	.3	.4	.1	.1	.1	3.0	.9	.2	(3)	.8
East North Central	109.6	57.0	17.9	1.9	.9	1.4	7.5	3.0	2.0	7.6	4.3	.1	6.0
West North Central	202.7	114.9	17.8	1.8	3.0	8.9	21.5	2.9	3.0	15.4	7.2	.5	5.8
South Central	42.7	25.3	3.7	.8	.6	.7	1.4	.4	3.0	2.4	2.2	.1	2.1
Far West	27.9	16.9	1.2	.1	1.4	2.0	1.3	.4	.7	1.1	.8	.8	1.2
Total	414.3	227.8	46.0	5.0	6.5	13.4	32.3	7.3	12.5	29.2	15.3	1.5	17.5
Barley (bushels):													
East North Central	5.4	2.3	.9	.1	.1	.1	.8	.2	.1	.2	.1	(3)	.5
West North Central	51.4	30.9	2.6	.2	1.0	2.7	6.3	.6	.6	3.4	1.4	.2	1.5
Far West	17.2	11.5	1.0	.1	.8	.4	.8	.1	.5	.3	.3	.6	.8
Total	74.1	44.7	4.5	.4	1.9	3.2	7.8	.9	1.2	4.0	1.9	.8	2.8
Flaxseed (bushels):													
Total	10.2	6.0	.3	(3)	1.1	.5	.8	.1	.1	.6	.3	(3)	.4
Rice (bushels):													
South Central	6.9	2.6	1.2	.5	.1	(3)	.1	.6	.1	.4	.3	.1	.9
California	.4	.1	(3)	------	(3)	------	.1	(3)	(3)	------	------	(3)	.2
Total	7.4	2.7	1.3	.6	.1	(3)	.1	.7	.1	.4	.3	.1	1.0
Potatoes (bushels):													
North Atlantic	47.2	16.2	6.8	.2	2.2	.1	.6	.1	.7	13.0	4.8	(3)	2.5
South Atlantic	10.2	5.5	.7	.1	.3	.1	.1	(3)	.1	1.1	1.4	(3)	.8
East North Central	44.3	20.6	5.4	.4	3.2	.1	1.2	.1	.6	6.1	4.5	(3)	2.1
West North Central	36.4	21.9	3.2	.4	1.1	.3	1.4	(3)	.5	2.2	4.1	.1	1.2
South Central	9.9	5.7	.7	.1	.3	.1	.2	(3)	.1	.3	1.7	(3)	.7
Far West	16.9	8.1	.4	.1	1.9	.2	.4	(3)	.3	2.6	.9	.3	1.7
Total	164.8	78.0	17.2	1.3	8.9	.8	3.9	.2	2.5	25.3	17.4	.5	8.8
Tobacco (pounds):													
North Atlantic	19.1	7.9	1.6	.2	2.4	2.8	.1	.7	.6	.3	1.4	(4)	1.1
South Atlantic	114.1	43.6	22.3	3.9	2.4	4.4	.8	3.0	2.2	2.9	19.8	(4)	8.8
East North Central	39.5	13.8	6.5	.8	6.8	2.3	.4	.7	.7	.9	3.6	(4)	3.0
South Central	123.6	53.7	25.1	5.1	3.9	2.7	1.3	.8	2.5	1.7	14.1	.1	12.6
Total	296.3	119.0	55.4	10.0	15.6	12.1	2.7	5.3	5.9	5.8	38.9	.1	25.5
Hay (tons):													
North Atlantic	3,128	1,927	278	18	172	11	48	23	282	16	85	2	266
South Atlantic	1,043	690	100	34	18	9	16	9	57	6	16	1	87
East North Central	4,258	2,431	441	58	159	9	117	32	527	21	128	2	333
West North Central	6,441	4,922	401	99	53	47	260	26	349	11	104	7	162
South Central	1,704	1,157	181	44	13	5	54	16	64	10	19	1	140
Far West	3,839	2,414	266	49	241	51	84	45	157	35	206	90	201
Total	20,414	13,542	1,667	301	657	131	580	151	1,436	100	557	103	1,189
Cotton (pounds):													
South Atlantic	870.4	213.3	214.8	35.4	64.8	15.4	31.8	19.7	24.3	95.9	93.8	.1	61.1
South Central	2,860.6	1,078.7	249.8	74.5	75.7	35.0	129.2	53.1	42.1	114.2	912.6	2.4	93.3
Total	3,731.0	1,292.0	464.6	109.9	140.5	50.4	161.0	72.8	66.5	210.1	1,006.3	2.4	154.5

[3] Less than 50,000 bushels.

[4] Less than 50,000 pounds.

Based on quantitative measurements and considering the country as a whole, deficient moisture is again the leading cause of crop damage to each of the crops here covered, excessive moisture ranking second for corn, oats, rice, tobacco, and hay. In the case of wheat, plant disease is the second most important cause of damage, with insect pests third, and these causes also retain this relative importance in potatoes. In the case of barley, hot winds come second as a source of damage, while with cotton insect pests occasion almost as much damage on the average as does deficient moisture.

The figures in Table 3 indicate that, considering a crop which is 10 per cent above the normal as a perfect or no-damage crop, and applying average farm prices to the quantitative losses of each crop for each year, this total annual crop damage in the United States to the crops here considered varied during the 11 years 1909 to 1919, inclusive, from a minimum of 2,054 million dollars in 1912 to a maximum of nearly 3,066 million dollars in 1918. The average annual crop damage during the 11-year period was 2,620 million dollars. These loss figures in terms of dollars are particularly convenient in making comparisons, but, for reasons stated on page 14, they do not represent the actual monetary loss to farmers through a reduction of the yield.

TABLE 3.—*Annual crop damage from specified causes in the United States, for the 11 years, 1909 to 1919, inclusive*

[In millions of dollars]

Crop and year	Total loss	Adverse weather conditions								Plant diseases	Insect pests	Animal pests	Other and unknown [2]
		Deficient moisture	Excessive moisture	Floods	Frost	Hail	Hot winds	Storms	Other climatic [1]				
Wheat:													
1909	240.7	81.4	35.8	7.4	4.0	21.3	12.3	6.7	28.2	17.5	12.5	2.8	10.8
1910	378.9	205.4	10.0	1.7	10.0	6.1	27.8	1.8	69.3	9.0	24.4	4.3	9.1
1911	454.2	294.8	9.6	.1	19.5	4.9	46.9	.7	4.9	23.2	28.8	2.0	18.8
1912	328.4	91.3	19.9	3.4	13.5	18.1	20.1	4.3	97.3	19.9	24.5	3.8	12.3
1913	303.2	184.9	4.8	2.1	8.3	8.4	22.4	3.0	21.2	3.6	28.7	1.5	14.3
1914	271.6	88.9	19.7	2.0	4.9	13.4	38.0	3.3	12.1	42.4	36.3	1.5	9.1
1915	308.4	17.6	119.0	16.5	6.3	23.8	1.7	5.8	13.5	36.9	56.2	1.8	9.3
1916	498.0	89.9	47.8	8.3	8.3	16.9	33.0	2.7	72.3	154.4	51.2	1.3	12.0
1917	397.1	205.2	6.2	1.4	5.6	10.7	17.8	2.0	123.7	8.7	8.7	1.2	5.9
1918	393.2	224.8	4.6	2.0	8.0	16.1	30.6	3.3	52.8	22.8	16.4	4.0	7.8
1919	685.0	219.1	114.8	8.3	9.8	14.3	50.7	5.4	19.0	187.0	46.3	1.3	9.0
Corn:													
1909	887.3	392.1	215.2	44.6	30.5	15.4	45.4	21.7	7.3	6.8	69.9	10.7	27.7
1910	825.8	442.8	94.5	24.1	29.0	11.8	50.0	15.6	7.4	7.1	75.1	12.4	56.0
1911	1,083.4	750.6	51.7	.1	14.8	6.2	109.2	1.8	18.2	7.9	73.4	5.2	44.3
1912	858.6	277.2	150.1	29.8	54.7	15.2	31.4	9.0	16.8	8.9	158.4	11.3	95.8
1913	1,213.9	851.3	25.1	10.2	24.7	12.0	119.3	13.0	10.8	1.2	112.5	2.6	31.2
1914	961.5	652.6	40.1	11.5	11.4	16.0	66.2	11.9	7.0	3.3	115.0	2.9	23.6
1915	963.0	97.4	384.5	65.6	202.5	20.2	7.4	39.2	35.1	8.5	70.1	2.7	29.8
1916	1,103.5	570.9	190.8	63.7	51.1	12.2	52.3	40.2	13.1	9.9	64.8	3.3	31.2
1917	1,187.8	446.9	100.1	20.3	447.0	21.0	43.0	12.3	15.7	10.0	51.8	2.4	17.3
1918	1,189.3	715.3	29.1	17.9	58.2	12.5	184.0	11.0	8.8	8.9	82.2	2.7	58.7
1919	765.3	321.6	221.8	41.9	4.8	8.0	28.3	14.0	4.1	11.0	93.0	2.6	14.2

[1] Including winterkill.

[2] Including defective seed.

TABLE 3.—*Annual crop damage from specified causes in the United States, for the 11 years, 1909 to 1919, inclusive*—Continued

Crop and year	Total loss	Adverse weather conditions								Plant diseases	Insect pests	Animal pests	Other and unknown
		Deficient moisture	Excessive moisture	Floods	Frost	Hail	Hot winds	Storms	Other climatic				
Oats:													
1909	154.1	55.9	35.7	4.0	4.1	7.3	6.1	5.6	3.3	16.9	3.8	0.7	10.7
1910	176.7	124.4	6.0	1.1	4.3	3.1	12.1	2.6	3.2	7.1	4.8	1.3	6.7
1911	291.1	202.7	8.0	.1	3.5	2.4	37.3	.7	6.1	5.5	10.6	.9	13.3
1912	134.3	52.3	25.2	2.4	3.2	7.3	7.5	3.6	4.6	12.6	5.2	1.3	9.1
1913	231.7	173.3	5.8	1.4	1.6	4.8	13.4	1.9	5.7	4.1	8.2	.6	10.9
1914	212.3	121.4	17.6	1.4	1.8	6.1	19.5	3.3	3.5	14.7	13.0	.6	9.4
1915	136.9	15.8	65.8	7.6	2.0	8.0	.9	6.8	2.7	17.6	2.6	.5	6.6
1916	230.5	88.7	33.9	3.4	2.5	7.0	21.5	4.3	8.0	40.4	11.9	.4	8.5
1917	180.0	107.3	11.8	1.4	3.9	6.6	8.9	2.4	22.8	6.8	3.7	.4	4.0
1918	188.6	118.8	4.8	1.5	4.6	7.8	15.6	2.8	9.4	9.8	7.8	.5	5.2
1919	251.0	97.4	51.1	3.7	1.4	5.2	21.7	3.7	4.8	39.3	17.4	.3	5.0
Barley:													
1909	38.7	15.8	6.0	.6	1.2	3.2	3.6	1.2	.7	2.2	.6	.9	2.7
1910	70.8	55.7	.5	.1	1.4	1.3	6.5	.2	.7	.7	1.3	1.2	1.2
1911	65.1	45.2	2.4	------	1.5	.6	9.0	.1	.7	1.3	1.4	.6	2.3
1912	33.7	14.5	3.8	.2	1.5	2.9	2.7	.9	1.1	1.4	.8	1.1	2.8
1913	57.2	41.3	1.5	.1	.7	1.6	5.0	.5	1.2	.3	1.9	.3	2.8
1914	36.8	13.5	4.4	.3	1.3	2.2	7.0	.7	.5	3.2	1.1	.5	2.1
1915	17.2	2.7	5.1	.4	1.0	2.4	.8	.8	.3	1.6	.4	.4	1.3
1916	50.5	14.9	5.4	.5	1.3	2.3	7.6	.8	2.0	12.6	1.1	.3	1.7
1917	64.6	50.9	1.3	.1	1.8	2.0	4.6	.4	.4	1.1	.8	.3	.9
1918	62.1	45.3	1.0	.2	1.5	2.2	4.6	.6	.6	1.3	3.1	.4	1.3
1919	59.8	30.2	4.6	.7	.5	2.3	6.2	.4	.4	7.8	5.7	.3	.7
Flaxseed:													
1910	40.2	31.5	------	------	1.6	.6	4.0	(3)	(3)	.8	1.2	.1	.4
1911	25.9	11.7	.8	------	5.9	.6	2.0	.1	.7	1.5	1.2	(3)	1.4
1912	19.6	3.8	2.2	.2	4.4	2.0	.8	.6	.1	2.7	.3	.3	2.2
1913	20.4	14.4	.4	.1	.6	1.0	1.3	.1	.3	1.0	.1	------	1.1
1914	12.4	4.8	.8	.1	.8	.8	2.8	.1	.1	.9	.2	.1	.9
1915	7.0	.8	.7	.1	3.0	.8	.1	.1	.2	.9	------	(3)	.3
1916	6.6	1.3	.8	.1	.6	.6	1.1	.1	.1	1.5	.1	------	.3
1917	31.9	26.3	.2	(3)	1.5	.6	1.5	------	.4	.6	.6	------	.2
1918	19.4	12.9	.1	(3)	1.6	1.2	1.2	.1	(3)	.5	1.3	------	.4
1919	24.5	15.5	.5	.3	.2	.7	1.4	(3)	(3)	1.3	4.3	(3)	.1
Rice:													
1909	5.3	1.4	(3)	------	------	------	.4	2.0	------	.8	.3	.1	.2
1910	6.4	2.6	.6	------	.1	------	(3)	.4	------	1.2	.1	.4	.8
1911	5.1	2.3	1.1	------	.1	------	.2	------	(3)	.2	.2	.2	.7
1912	7.2	1.1	.4	2.3	------	------	.2	.2	(3)	.9	.7	.2	1.1
1913	12.0	1.6	6.0	2.5	------	------	(3)	------	------	(3)	.3	------	1.6
1914	6.2	1.9	.8	(3)	------	(3)	.2	.2	.5	(3)	.5	(3)	2.1
1915	8.3	3.0	.3	(1)	(1)	------	.1	3.5	.2	.2	.1	------	.9
1916	3.9	2.1	.1	------	.1	------	.1	.1	.1	.5	.1	------	.7
1917	12.7	8.7	.4	.1	.7	.1	(1)	(1)	(1)	.2	.1	.2	2.1
1918	12.2	4.0	4.0	1.4	.1	------	.2	.8	------	.2	.6	(1)	.9
1919	10.7	.5	6.7	.6	.2	------	(1)	1.3	.4	.2	.3	.4	(1)
Potatoes:													
1909	96.6	50.6	13.2	1.5	7.7	.9	.8	.2	.6	7.8	7.9	.5	4.9
1910	132.7	73.7	5.9	.8	5.2	.6	1.6	.1	1.6	15.0	21.5	.7	6.0
1911	184.2	117.1	6.2	.1	5.6	.2	13.0	(1)	2.6	12.0	11.7	.5	15.2
1912	97.6	26.2	13.6	1.5	2.6	.6	1.1	.3	1.7	26.9	16.1	.7	6.3
1913	152.4	98.4	4.6	.7	8.5	.6	3.1	.2	3.0	6.3	16.6	.3	10.1
1914	114.2	72.0	6.2	.6	3.0	.5	2.0	.1	1.3	5.8	14.1	.2	8.4
1915	142.0	9.8	40.9	2.0	9.0	.6	.2	.3	1.3	62.1	11.1	.2	4.5
1916	183.9	79.7	29.2	1.7	8.1	.9	5.5	.3	5.6	24.9	19.4	.2	8.4
1917	130.3	47.6	19.7	1.2	15.1	1.0	1.6	.2	1.6	24.2	13.0	.2	4.9
1918	149.9	77.2	5.3	1.0	8.1	.4	3.1	.2	1.5	28.6	17.5	.2	6.8
1919	181.3	74.6	24.4	2.0	3.5	.5	3.4	.3	1.3	44.2	22.1	.2	4.8
Tobacco:													
1909	40.1	11.9	13.3	2.1	1.4	1.8	.2	.4	.3	1.4	5.2	------	2.1
1910	43.5	10.4	14.3	2.6	.6	.7	.1	.3	1.6	1.4	5.9	(3)	5.6
1911	35.8	25.6	1.3	------	2.3	.1	.9	(3)	.9	.5	1.5	(3)	2.7
1912	40.6	14.8	8.8	1.4	.9	2.1	.3	.5	.6	1.3	5.3	.1	4.5
1913	45.4	26.0	1.6	.7	2.1	2.6	.5	1.3	.8	.3	6.1	(3)	3.4
1914	47.8	34.7	.4	.1	.6	1.2	.6	.3	.8	.1	5.6	(3)	3.3
1915	49.6	9.2	16.2	1.8	2.1	1.7	.3	2.0	1.0	1.3	8.6	-----	5.4
1916	43.1	7.6	13.8	3.3	2.6	2.3	.2	2.1	1.1	.7	6.6	-----	2.8
1917	36.6	7.6	5.9	1.2	7.4	3.0	.2	.5	1.0	.6	5.3	(3)	3.9
1918	34.1	18.5	1.4	.5	1.7	2.6	.4	.6	.4	1.0	5.6	-----	1.4
1919	72.7	22.5	30.4	2.2	.7	2.9	.2	.7	.8	2.2	8.7	-----	1.4

[1] Including winterkill.

[3] Less than $50,000.

TABLE 3.—*Annual crop damage from specified causes in the United States, for the 11 years, 1909 to 1919, inclusive*—Continued

Crop and year	Total loss	Adverse weather conditions								Plant diseases	Insect pests	Animal pests	Other and unknown
		Deficient moisture	Excessive moisture	Floods	Frost	Hail	Hot winds	Storms	Other climatic				
Hay:[4]													
1909	230.4	144.0	27.2	6.6	3.1	1.4	3.2	3.5	16.9	1.4	6.3	2.2	14.6
1910	294.3	215.7	14.1	3.4	8.5	1.2	5.6	.9	14.4	.9	6.9	2.4	20.3
1911	404.2	320.2	9.4	.2	11.6	1.2	21.9	------	5.9	1.1	6.8	1.1	24.8
1915	185.7	52.7	60.6	7.2	16.8	2.1	1.3	4.5	12.8	3.0	7.8	1.1	15.8
1916	139.6	78.4	15.1	4.6	8.8	1.2	2.5	1.9	12.8	.6	4.2	.5	9.0
1917	250.9	156.9	18.4	2.7	4.4	2.3	4.5	1.8	37.6	1.0	5.6	.8	14.9
1918	345.5	242.0	11.1	2.7	9.5	1.7	10.9	1.4	34.7	1.3	12.9	.7	16.6
1919	232.9	149.4	29.5	5.1	5.1	1.0	4.8	1.9	12.1	1.9	13.8	.6	7.7
Cotton:													
1909	607.7	210.6	92.0	16.5	10.2	8.3	42.6	19.0	15.1	63.8	110.1	.1	19.4
1910	540.8	181.2	82.8	13.4	31.0	4.0	19.3	2.2	10.9	67.5	109.3	.5	18.7
1911	433.0	163.7	42.6	.2	4.7	1.5	26.6	6.3	10.3	7.9	128.9	.4	39.9
1912	533.8	128.2	131.4	19.3	15.7	9.6	19.5	2.9	14.9	71.5	101.3	1.2	18.3
1913	582.9	263.3	34.8	14.4	18.2	8.0	41.1	8.9	12.2	8.5	152.0	.1	21.4
1914	437.3	137.7	49.2	8.6	15.8	6.6	11.3	2.4	9.3	4.3	165.0	.2	26.9
1915	543.1	104.3	83.8	27.9	8.2	9.4	16.9	28.3	9.4	29.1	173.9	.4	51.5
1916	700.9	148.8	158.6	53.5	6.4	10.8	10.2	32.9	4.1	14.8	251.5	.5	8.8
1917	632.6	232.8	28.3	8.3	98.2	17.0	10.7	3.0	6.7	22.4	191.6	------	13.6
1918	671.4	388.9	15.1	6.2	8.8	2.1	46.5	5.1	9.0	34.7	135.3	.3	19.4
1919	660.9	43.1	241.5	26.4	3.8	3.7	7.0	7.9	2.2	22.5	294.4	------	8.4
Total:													
1909[5]	2,300.9	963.7	438.4	83.3	62.2	59.6	114.6	60.3	72.4	118.6	216.6	18.0	93.1
1910	2,510.1	1,343.4	228.7	47.2	91.7	29.4	127.0	24.1	109.1	110.7	250.5	23.3	124.8
1911	2,982.0	1,933.9	133.1	.8	69.5	17.7	267.0	9.7	50.3	61.1	264.5	10.9	163.4
1912[6]	2,053.8	609.4	355.4	60.5	96.5	57.8	83.6	22.3	137.1	146.1	312.6	20.0	152.4
1913[6]	2,619.1	1,654.5	84.6	32.2	64.7	39.0	206.1	28.9	55.2	25.3	326.4	5.4	96.8
1914[6]	2,100.1	1,127.5	139.2	24.6	39.6	46.8	147.6	22.3	35.1	74.7	350.8	6.0	85.8
1915	2,361.2	313.3	776.9	129.1	250.9	69.0	29.7	91.3	76.5	161.2	330.8	7.1	125.4
1916	2,960.5	1,082.2	495.5	139.1	89.8	54.2	134.0	85.4	119.2	260.3	410.9	6.5	83.4
1917	2,924.5	1,290.2	192.3	36.7	585.6	64.3	92.8	22.6	209.9	75.6	281.2	5.5	67.7
1918	3,065.7	1,847.7	76.5	33.4	102.1	46.6	297.1	25.9	117.2	109.1	282.7	8.8	118.5
1919	2,944.1	973.9	725.3	91.2	30.0	38.6	123.7	35.6	45.1	317.4	506.0	5.7	51.3

[4] Figures for 1912, 1913, and 1914 not available. [5] Excluding flaxseed. [6] Excluding hay.

An examination of the total damage to given crops indicates, as might be expected, a variation in most cases greater on a percentage basis than the variations in annual totals for all crops. These variations are particularly marked in the case of wheat, barley, flaxseed, and rice. They are smallest in the case of corn, owing largely, no doubt, to the general distribution of the corn acreage in the United States.

Lastly, an examination of the figures representing the damage to given crops from specified causes shows the relative variations to be even greater. Thus the variations in damage to the wheat crop from deficient moisture range from less than 18 million to 295 million dollars, while those of cotton from the same cause range from 43 million to nearly 389 million dollars. On a relative basis the variation in damage to individual crops from some of the less important causes would be still more striking. In the case of hail damage to cotton, for example, the variation is from 1½ million to 17 million dollars.

Deficient moisture and excessive moisture might also be expected to have an inverse relationship. the damage from one of these causes tending to be relatively light in years when the damage from the other

is relatively heavy. This is well illustrated by the two columns given to these causes. Little, if any, relationship of this kind is noticeable, however, between the two causes of frost and hot winds, which, in a modified way, also represent opposite extremes.

Extended comment on the tables seems unnecessary. It should be emphasized, however, that the figures for crop damage in terms of dollars represent, in part, a theoretical loss only. While an increase of 10 or 20 per cent in the yield of a given crop will increase the gross income of an individual farmer from that crop by the same percentage, this relationship between increase in yield and increase in gross income does not hold when all or even a large proportion of the entire farmer group is considered. In this case increase in yield will, of course, materially affect the total supply of the commodity in question, which naturally affects the price. No attempt has been made to allow for this fact in translating the quantitative crop damage into terms of dollars. Table 3, which shows damage to all crops in the common denominator of dollars, will, therefore, be of more value for purposes of making comparisons between the amount of damage to different crops and in different regions than as a measure of actual diminution in the income of the farmers by reason of damage to their crops.

ELIMINATION OR REDUCTION OF RISK

SELF-INSURANCE

While the individual farmer can not control the action of the weather or the elements, and frequently finds himself unable to combat the attacks of plant disease and insect pests, he can to a great extent reduce the losses that would result from the absence of proper care and forethought. In farming, as well as in other lines of activity, the old advice against putting all the eggs in one basket should be heeded as far as practicable. The single-crop farmer exposes himself to the possibility of losing the results of an entire year's work from a single catastrophe. Almost any one of the causes of crop damage enumerated in foregoing Tables 1, 2, and 3 may make his year's work a total loss. If, on the other hand, he invests part of his capital and labor in livestock, or in a variety of crops other than the main money crop of the region, it is highly improbable that the causes of loss affecting one of his investments will also seriously affect the others. The same plant diseases and insect pests rarely, if ever, affect all crops that can be grown in a given locality, and even damage from climatic causes, such as drought, excessive moisture, frost, or hail, rarely brings about a total destruction of all crops in a region. While all the crops in a given locality may be affected to some degree by each of these climatic contingencies, they probably will not be equally subject to damage from a given cause at the same time. In other words, the chances are that the critical period of one crop with reference to any one of these hazards will be past before the corresponding period of another crop is reached. Diversification, therefore, becomes a form of self-insurance.

The added safety to the farmer that lies in reasonable diversification of crops and products is becoming recognized to an increasing extent by country bankers, as well as by the farmers themselves.

Many bankers in regions where a one-crop system has prevailed now insist as a condition to the granting of a loan to the farmer that he shall fill out and sign a credit statement, including an agreement to use a safe cropping system. This change of attitude on the part of banking interests, from one of encouraging the farmer to stake his success on a single crop to a position of urging him to play safe in so far as circumstances permit, represents an important advance in profitable relationship between the banker and the farmer.

A study of available information covering dates of the last killing frost in the spring and of the first killing frost in the fall, as well as that bearing on seasonal rainfall and temperature for his locality, will enable the farmer, within limits, to adjust the planting and, hence, the growing season of his crops in such a way as to incur a minimum of risk from these causes of crop damage. In this connection should be mentioned the importance of reducing risks of loss by the careful selection for seed purposes of varieties of the different kinds of crops which mature within the space of the reasonably safe growing season of a given locality.

At Grand Rapids, Mich., for example, the average date of the last killing frost in the spring is May 11, while the average date of the first killing frost in the fall is about October 8. This gives an average growing season of 150 days for crops which are readily injured by frost. Weather Bureau records further indicate that five times in 20 years the date of the last killing frost in the spring had been 10 days or more later than the average, and, similarly, that four times in 20 years the date of the first killing frost in the fall had been 10 days or more earlier than the average date. The reasonably safe growing season for crops subject to damage by frost in this locality, therefore, is a little less than 130 days, covering a period from the last week in May to the last week in September. By adjustment of his dates of planting, as well as by the selection of the varieties of grains planted with careful regard to local climatic conditions as revealed by data covering extended periods of time, the farmer, in effect, can insure himself against frequent losses from frost. To a certain extent, he can also adjust his plan of farming to minimize the losses from drought and other climatic dangers.

Thus far we have considered only safeguards against forces which the farmer can not control and against which his only chance, with minor exceptions, is to adjust his business in such a way that the least possible danger will result from their adverse action. There are, however, many other causes of loss which can be directly eliminated or at least partially removed.

Loss from failure of seed to germinate can be eliminated to a great extent by planting only tested seed. This is particularly true in the case of crops, such as corn, where the germinating quality is frequently injured, even when the yield is bountiful and the crop, to all outward appearances, is sound. Individual plant diseases, such as smut in wheat, oats, and barley, may be eliminated by a single treatment of the seed before planting. In sections where wheat scab occurs this evil may be largely controlled by a system of rotation in which wheat never directly follows corn, unless the corn is cut for fodder and all litter removed or thoroughly covered by plowing in

the fall. The elimination of black rust by the removal of the common barberry bush is a method of insuring against loss from this source. In the case of certain insect enemies, spraying or poisoning by one method or another may reduce or even eliminate their ravages. It is, of course, neither practical nor necessary to apply all preventive treatments at all times. The progressive farmer keeps himself informed as to the invasion of his region by any common disease or insect pest and takes all available preventive measures against danger of loss or damage. Similar safety measures apply to many of the diseases that occasion losses among the farmer's livestock. By the timely application of vaccines, dipping, or other treatment many of the losses that threaten may be avoided.

As a final illustration of the reduction of risk by individual action, or self-insurance, the provision for a reserve against years when the income is materially less than the average may be mentioned. Many a farmer, who for one or more years has met with success and enjoyed a liberal income, recklessly assumes that each succeeding year will be equally profitable. On this assumption he expands his operations and strains his credit to the limit. A single year of failure may cause him to lose not only the results of that year's labor but very probably also his capital accumulated from the success of former years.

The reserve against lean years may be in the form of a savings account at the bank or a bond that is stable in value and readily marketable. A legal reserve life-insurance policy with its loan and cash-surrender features also constitutes a good emergency reserve in addition to the protection that it provides for dependents. In the case of the farmer with limited capital the suggested reserve may be given the form merely of an improved credit status. This may need a word of explanation.

Farmer D, who has already borrowed to the limit and has all his property pledged as security for loans, in a given year reaps a good harvest and receives good prices for his surplus products. Instead of reducing his indebtedness, after selling his crops, he renews such of his outstanding loans as expire, paying only the interest thereon. He then uses all his net income of the year to buy more land or other property, paying part cash and giving a mortgage on the newly acquired property for the balance. He has added to the property nominally his, but has improved his credit status little if at all. His margin of safety is no greater than it was before and he is about as likely to lose all he has by reason of a bad season as he was the year before.

Farmer E, on the other hand, whose property is also mortgaged to the limit before the reaping of a profitable harvest, uses his net income to reduce his outstanding debts. His livestock is cleared of mortgage and he makes a small prepayment on the mortgage on his farm. This man has added nothing to his outward possessions, but he has strengthened his hold on that which already was technically his. He has increased his margin of safety. In case of future need of loans he has security to offer. In other words, he has a form of reserve set aside from his prosperous year.

INSURANCE BY CONTRACT

Tables 1, 2, and 3 give some idea at least of the extent of the hazards and the losses to which the producer of crops is exposed. Many of these hazards may be reduced or even eliminated by the principles of self-insurance already mentioned. Even after this is done, however, there remains a large element of risk in the production of crops which can be adequately cared for only by a reliable contract for indemnity, or, in other words, by insurance in the technical meaning of the term.

The only insurance hitherto generally available for the risks or hazards in crop production has been that of hail insurance, and even this form of coverage is of relatively recent origin. Hail insurance on growing crops has grown during the last decade into a business of some magnitude. The total premiums for 1919, which marks the highest point yet reached, exceeded $30,000,000. More than half of these premiums were collected by joint-stock fire insurance companies, about 60 in number, which write hail insurance more or less as a side line. The remainder was divided almost equally between specialized hail insurance companies doing business on the mutual plan and State hail insurance funds or departments. The total risks covered amounted to about $560,000,000. Almost one-half of these risks was carried by the joint-stock companies and the other half was divided equally between the mutuals and the State departments in North Dakota, South Dakota, Montana, and Nebraska.[1]

A certain amount of fire insurance has also been written on standing grain in some States of the West. This form of insurance is most common in districts where large acreages of wheat are left standing until thoroughly ripe and dry and then cut and threshed in a single process. The insurance takes effect on the grain in the field and as a rule follows it until it is sold or stored in a commercial elevator or warehouse.

In recent years attempts have been made to work out a more general plan of insurance coverage for farm crops. The first attempts of this kind were made in 1917, when three joint-stock fire insurance companies offered crop insurance in North Dakota, South Dakota, and Montana. Two of these companies wrote practically identical contracts, and the contract of the third differed but little from the others. A brief outline of the leading features of the plan follows.

The insurance covered all the hazards to which crops are subject, with the exception of fire, floods, winterkill, and failure on the part of the farmer properly to till and care for his crops. The hail hazard was specifically included in the coverage offered by this form of policy. The amount of insurance was fixed at the relatively low figure of $7 an acre and the insurance applied to a specified field area, the crops on which might include any or all of the following grains—wheat, flax, rye, oats, barley, and spelt. In case of total failure of the crop on such area, the company agreed to pay the face value of the policy, or $7 an acre. In the event of partial loss, the indemnity provided for was equal to the difference between the value of the crop harvested on the field area insured and the face of the policy, it being specifically stipulated that the entire area insured in a given policy should be considered a single risk. Furthermore, the partial crop

[1] U. S. Dept. Agr. Bul. 912, Hail Insurance on Growing Crops in the United States, p. 11.

was valued at prices stipulated in the policy, namely, wheat, $1; flax, $1.75; rye, 70 cents; and oats, barley, and spelt, 50 cents a bushel. The insurance, therefore, even though written in terms of money, covered yield rather than returns on a monetary basis. In other words, the insured was protected in a measure against crop damage, but not against a possible drop in the prices of the crop produced. Adjustment of all partial losses was necessarily postponed until after the insured crops had been threshed.

These first attempts at general crop insurance proved rather disastrous for the companies that undertook them, owing, in part, to the severe drought that occured in large sections of the States mentioned and, in part, to inadequate safeguards by the companies against the assumption of risks after severe damage had already taken place. The losses incurred under these contracts were to a considerable extent repudiated by the companies. Inability to settle in full was plead. In some cases fraud on the part of the insured was alleged and many claims were tentatively settled by the return of the premium collected. The outcome of this first attempt to provide a general crop coverage is much to be regretted.

For two years following these experiments of 1917, no general crop insurance, so far as the author is aware, was written in the United States. During the last two years, however, the plan of offering a crop-insurance contract has been revived, at least two of the larger fire-insurance companies having written such contracts.

One of these policies, which was written by one of the two companies quite extensively during 1920, in effect guarantees the farmer a specified income from each acre insured unless damage results from fire, hail, wind, tornado, failure of the seed to germinate, or failure on the part of the farmer properly to do his part in seeding, cultivating, or harvesting the crop. Losses or damage through the elements, including frost, winterkill, flood, and drought, and from insects or diseases are specifically covered by the policy.

The amount of insurance to the acre written is based on the investment in the crop as determined by allowing a fixed amount for each process in preparing for, cultivating, and harvesting the crop in question plus an allowance for seed and for rental value of the land. Unlike the contract described above, the policy does not place a fixed value on the grain harvested, but provides instead for valuation on the basis of market price at the time of adjustment. The company, therefore, in effect, gives protection against a drop in prices, as well as against crop damage. This feature of the policy caused the venture to prove a costly one to the company in 1920 because of the unexpectedly heavy drop in prices.

A crop policy even more recently devised involves a plan materially different from either of those already described. The coverage as to hazards insured against is, however, practically the same as in the contract just outlined. In neither of these policies is the hail hazard covered. Under the plan embodied in this policy, however, the amount of insurance to the acre that an applicant may receive is based on a certain percentage of his average yield during the past five years, such part of the average yield being translated into dollars by applying to it a value per bushel or other proper unit of measure based on the price prevailing during the period in question. Thus a farmer who on a given farm during the past five years has averaged

48 bushels of corn an acre may be offered insurance in an amount equal to the value of about 36 bushels at the average price for corn during the past five years. If such average price were found to be 50 cents a bushel the insurance might be placed at $18 an acre.

One of the most important differences between this policy and either of those previously described is the plan provided for settlement of losses. In the case of total destruction of the insured crop the company agrees to pay 75 per cent of the cost of the field operations actually performed, such indemnity not to exceed 75 per cent of the total insurance carried. Furthermore, it is provided that the indemnity shall in no case exceed the cost of replacing all or any part of the quantitative returns on which the insurance is based with products of like kind and sound quality. Finally, it is provided that indemnity shall in no case exceed the amount, if any, by which the amount insured exceeds the market value of the crop harvested. Under this provision a change in price in either direction may be taken advantage of by the company.

PRINCIPLES OF CROP INSURANCE

The need of the farmer is a form of insurance that (1) will safeguard him as far as practicable against all unavoidable losses which would seriously cripple him, and (2) can be obtained at a cost or premium which he can afford to pay.

This means, in the first place, that the protection must be limited to actual loss of a material part of the investment in a crop, reasonable compensation for the farmer's labor, and a fair rental of the land being included in such investment. If it is attempted also to cover the loss of prospective profits by partial damage to a crop promising a yield above the average, the cost is sure to be prohibitive.

If insurance consisting of the collection of premiums and the distribution of such premiums to those incurring a loss under the insurance contract could be conducted without expense, it might be wise to insure against every conceivable source of loss, thereby practically equalizing and standardizing the income. It is, of course, no more possible to achieve this than it is for a locomotive to turn into tractive power all the energy contained in the coal that it consumes. A greater or less proportion of the amount contributed by the insured as premiums must be used to meet the expense of conducting the business, or, to carry out the figure, to overcome the frictional element of the insurance machine. It is, therefore, possible in the long run for an insurance company to pay back in indemnities to its members or patrons only a materially smaller amount than the sum collected from the insured in the form of premiums.

The important fact to be made clear may be further explained by pointing out that, covering a period of years, a farmer ordinarily secures a greater net income by carrying his own risk than will accrue to him if he purchases any form of crop insurance from year to year. This is true, however, only on condition that no loss suffered is sufficiently serious to cause him to lose his farm or to handicap him in his farming operations. It must be concluded, therefore, that insurance is to be recommended against such crop losses as would seriously cripple the farmer. On the other hand, it is a form of

extravagance to insure against such losses as he can bear without undue inconvenience.

It may be laid down as another principle that the ideal crop insurance will, to the extent indicated, provide protection against all unavoidable hazards to which the crop is subject. If one of these hazards is left unprovided for in the insurance contract, the insured may lose his crop from that hazard and find himself worse off for having carried insurance by the amount of premium paid or premium obligation assumed.

In the final analysis, there is little more logic in carrying crop insurance against certain specified hazards with the insured carrying the total risk against other hazards than there would be in taking out a life insurance policy against certain specified diseases. The thing that the buyer of life insurance seeks is the positive assurance that in the case of his premature death the economic loss sustained by his dependents will to a greater or less extent be made good by the insurance. Similarly, the thing needed by the producer of crops is the assurance that if these crops fail to produce a reasonable harvest, no matter what the cause of such failure may be, assuming that he himself has fully performed his part, he will be indemnified for the loss he has sustained.

It is hardly necessary to point out that in no case should the insurance safeguard a man against his own negligence or carelessness. Any insurance which does this tends to create a form of moral hazard that no company can afford to assume and also to diminish the efficiency and productivity of agriculture as a source of national wealth.

While the crop-insurance policy to meet requirements fully must cover all unavoidable hazards, it would no doubt be going to extremes to assert that, in the absence of an offer of such a policy on favorable terms, no insurance should be purchased. In certain parts of the country the hail hazard is relatively severe. The average loss for a State by reason of hail is rarely if ever as large or as widespread as the loss from certain other climatic hazards, but the loss to those who do suffer from it is often very severe. Not infrequently the crops of individual farmers are totally ruined. Because of this peculiarity of the hail hazard, losses therefrom being concentrated on a relatively few and the damage therefrom being readily distinguishable from that brought about by other causes, it is practicable from the point of view of the insurance organization to give protection against this hazard alone and to hold down its expenses to a reasonable percentage of the premiums. The protection offered by hail insurance may be well worth what it costs. Where so-called crop insurance covering a variety of hazards is offered, however, the hail hazard should certainly be included. It should not be necessary for the farmer to secure two insurance contracts in order to be protected against serious or total loss. Economy in insurance operations and convenience to the insured argue for complete coverage in a single policy.

It has already been pointed out that the farmer can not wisely shift to an insurance company the risks which he can carry himself without undue danger to his safety and prosperity. It may also be emphasized that the farmer can not afford to buy insurance protection against any of his risks if the expense item involved in the insurance operation is unduly large. The insurance machine must operate with

reasonable efficiency if the seeker of insurance protection is to find it profitable for his needs. Assume, for instance, that 50 per cent or more of the premiums collected were absorbed in expense of operations, thereby making the total cost to all the insured equal or exceed twice the amount received by them in indemnities to cover losses incurred. It is obvious that it would be wiser for each one to take a chance on a serious loss and thereby have also a chance of retaining a liberal income in prosperous years. Under the conditions assumed, the purchaser of even a reasonable amount of protection would pay out in premiums a large part of his income in good years and possibly more than his net income in leaner years. Such an arrangement would insure his ruin rather than his success.

This illustration, of course, applies particularly to forms of insurance covering hazards which are not subject to human control. Certain kinds of insurance, such as that against fire, loss of livestock by disease or accident, and, even more, certain forms of casualty insurance, involve the buying of a service in the nature of loss prevention as well as a guaranty of indemnity in case loss occurs in spite of preventive measures. In such cases, insurance might be profitable even when premiums collected are relatively large in proportion to the indemnities distributed by the company. In the case of crop insurance, however, the service of the company consists not in loss prevention but merely in the collection of funds and the distribution of these funds as indemnities to those who suffer loss. Under such circumstances the expense item must be only a minor part of the total cost to the insured if the purchase of protection is to prove a wise investment.

Three relatively distinct forms of crop-insurance policies based on the methods of determining the amount of insurance to the acre and the indemnity due when losses are incurred were outlined on pages 16 to 18. Under the first of these plans the insurance an acre is made an arbitrarily fixed and uniform sum for each acre insured. Under the second plan the maximum insurance an acre written is determined on the basis of actual investment in the crop by placing a specified value upon each operation in preparing the soil and tilling and harvesting the crop and adding to this sum a reasonable allowance for seed and rental value of the land. Under the third plan the average yield on the land in question during the past five years, coupled with the price of the product during the same period, is made the basis for determining the amount of insurance.

The first of these three methods of determining a proper amount of insurance to the acre has the advantage of extreme simplicity. Obviously, however, the unmodified plan could not be applied to a wide range of crops in different sections of the country without either greatly underinsuring some risks or overinsuring others. For general application some method of adjusting the insurance an acre to the investment involved, or the crop value, is essential.

The question may then be raised: Is the investment in the crop as determined by the number and cost of the field operations performed plus seed and rental, or the average income over a period of former years as determined by yield and price, the better basis for arriving at a safe and proper amount of insurance to be written?

As between these two methods, the first may be said to be the easier to apply in so far as the agent writing the insurance is con-

cerned. The field operations already performed or to be performed before the crop is ready for market are easily translated into terms of dollars by means of simple tables showing the cost of each operation; and the cost of seed and fertilizer, if any, as well as the commercial rental value, can no doubt be determined without much difficulty. The plan does not readily lend itself, however, to a differentiation between good farming and poor farming except as these factors are evidenced by the number of field operations performed. In other words, unless the agent takes great personal care, the farmer who plows, disks, etc., in a slipshod manner, uses inferior seed, and exercises poor judgment in other respects, is likely to receive the same amount of insurance as the farmer who performs all field operations in a first-class manner, uses the best varieties of seed, and exercises sound judgment with reference to the time of seeding, caring for, and harvesting his crops. Moreover, while the commercial rental supposedly reflects the productivity of the farm, rents are to a great extent the result of established custom and do not, as rule, reflect with accuracy the productively of a given farm.

The other method, that of average yield and price, has the disadvantage of being somewhat cumbersome and difficult to apply. Few farmers keep records of their yields from year to year, and without such records few will be able to give with any degree of accuracy the yield obtained for each of five years past. Furthermore, a very considerable percentage of the tenant farmers will not have tilled the farm they occupy for a sufficient number of years to give a reliable average yield. The plan has the merit, however, of measuring past results in so far as it is possible to secure the facts, and these form the most reliable basis for estimating the future results which are the subject of the proposed contract.

The determination of the amount of insurance an acre to be written is particularly important in the general plan of insurance here considered. In the ordinary insurance contract the amount of insurance placed on the various risks determines the size of the indemnity in case of loss, but does not, debarring a moral hazard, affect the number of losses. Under the plan involved in each of the crop-insurance contracts hitherto written, however, the insurance an acre determines not only the size of the indemnities that will occur, but also the number of cases in which indemnity will be due. To insure the cornfields in a given State or locality at $24 an acre, or the equivalent in a stipulated yield, obviously involves not only twice, but many times, the risk involved in insuring the same fields at $12 an acre. From the farmer's standpoint the chance of collecting all or a part of the second $12 an acre would be several times the probability of collecting any part of the first $12. The wise farmer, therefore, when he buys insurance under this plan will buy as much an acre as the company is willing to give him. To a large extent, the company for the same reason can give justice as between good and poor land as well as between good and poor farmers in a particular locality, merely by an adjustment of the amount an acre written, and without making any change in the rate of premium. This plan is not uniformly applicable, however, for the reason that climatic conditions make wide variations from the average yield much more frequent in some localities than in others.

The best method of determining the indemnity due in case of loss raises an equally difficult question and one quite as important as that of determining the amount of insurance that may be written. The first of the three forms of contract outlined provides that in case the yield an acre valued at the price stipulated in the policy does not equal the amount of insurance an acre, the company will indemnify the insured to the amount of such difference. Under this plan it is of no financial consequence to the company whether prices go up or down. The risk involved in price fluctuations, in so far as it affects income from yield obtained, rests entirely on the farmer. A simple illustration will make this point clear.

A farmer insures his wheat at $7 an acre under this plan. The wheat is valued by agreement in the policy at $1 a bushel. By reason of drought or other cause the yield is reduced to 5 bushels an acre. The indemnity due under these conditions is $2 an acre, regardless of whether the local market price of wheat at harvest time is $0.75 or $1.50 a bushel. If the lower price prevails, however, the farmer will receive only $3.75 for the 5 bushels harvested, while he will receive $1 a bushel for each of the two bushels that he fell short of 7 bushels, the quantity in effect guaranteed him. His total income an acre will be $5.75. If, on the other hand, wheat sells for $1.50, the amount harvested will be worth $7.50, equal, with the $2 indemnity, to $9.50 an acre. To the company, however, it makes no direct difference whether prices advance or fall except as the collection of premiums not fully paid in advance may be affected.

In the case of the second form of policy outlined this situation becomes essentially reversed. Assume that a farmer insures his wheat at $12 an acre under this plan, which, as against the hazards covered, guarantees him a yield that at market price will equal the amount of insurance. In case of total destruction of his crop he will be paid for such operations and such investment as have been already made in connection with the destroyed crop. Suppose, however, that by reason of one or more of the hazards insured against, the yield is reduced to 8 bushels. If the wheat at harvest time sells for $1.50 or more, no indemnity will be due, since the amount harvested will bring a return equal to or greater than the sum stipulated in the contract. But suppose, on the other hand, that wheat falls to $0.80. The 8 bushels harvested will then be worth only $6.40 and the indemnity due will be $5.60 an acre. On the basis of this price, even a 12-bushel yield will call for an indemnity, assuming that damage has occurred from hazards covered by the contract, equal to the difference between $12 and $9.60, or $2.40 an acre. To the farmer suffering crop damage from causes covered by the contract in such degree that his actual yield at market price falls below the insurance an acre, it makes no difference under this plan whether the price is higher or lower. To the company, on the other hand, high prices mean few and small losses, while low prices mean numerous and relatively large losses.

Turning now to the third and last form of contract previously outlined, conditions based on fluctuations in price take on still another aspect. Under this plan the company in effect reserves to itself the right to make settlement in kind on the basis of the average yield used in determining the insurance an acre, at the same time

retaining the option of settling the claim on a basis of dollars an acre with the crop valued at market price.

Assume again that a farmer carries insurance of $12 an acre on his wheat, this figure in this instance having been determined by taking three-fourths of a 16-bushel average yield and an average price of $1 a bushel. Owing to one or more of the hazards insured against, the yield, as in the preceding illustration, is only 8 bushels an acre. Assume first that wheat following harvest is worth $1.50 a bushel. The company, of course, invokes the clause in its contract providing that its liability shall in no case exceed the amount, if any, by which the amount insured exceeds the market value of the crop harvested. Since the value of the 8 bushels harvested is $12, no indemnity is due. But suppose, on the other hand, that the price following harvest is only $0.80 a bushel. The company then relies on the provision that in no event shall its liability under the contract exceed the cost at the time of harvest to replace all or any part of the estimated yield with products of like kind and sound quality. The company, therefore, tenders the insured the equivalent of 4 bushels at $0.80, or $3.20. This sum, together with the 8 bushels harvested, also at $0.80, makes the gross returns to the insured $9.60 an acre.

Had wheat remained at $1 a bushel the indemnity would, of course, have been $4 an acre, but with a market price at harvest time standing at $1.50 the company pays nothing, and with a market price of $0.80 it pays only $3.20. As in the case of the preceding plan of contract here considered, the company has fewer losses by reason of the rise, while such losses as occur are reduced in amount. In the case of this last form of contract, however, the company benefits from a fall in price, as well as from a rise, while the insured who suffers damage has his indemnity reduced in proportion as the market price is lower than the price on the basis of which the amount of insurance was determined.

It should perhaps be pointed out in this connection that such changes in price as have been witnessed in the last few years are decidedly abnormal and that under relatively stable price conditions the third form of contract would be practically as advantageous as either of the other two. There is serious danger, however, that the applicant for insurance will not read his contract and will not have his attention called by the agent to the plan of settlement, so that when changes in price occur he will be expecting in case of loss an indemnity sufficient to make his income equal to the insurance an acre specified in dollars on the face of the policy.

A company writing a more liberal policy from the point of view of the insured must charge materially higher rates of premium than are required to carry out a contract with less favorable terms of settlement. Given a sufficient difference in premium, the third contract here considered might represent a better investment than either of the other two. A plan under which the company profits by a fall in price as well as by an advance, however, is not likely to inspire confidence and good will among the insured, even if allowance is made for this advantage to the company in the premiums charged.

Dropping this third plan of loss adjustment from further consideration, the question still remains: Should the company writing crop insurance assume a material part of the risk involved in a drop in

prices as well as that of crop failure, or should, in effect, yield only and not income be insured? Much can be said in favor of either of these two plans.

The first plan is more simple to administer since, the value of the crop being agreed upon in the contract, there can be no haggling over which one of continuously changing market prices shall be used in the settlement. Furthermore, the farmer and not the company determines what crop shall be planted and insured. The adjustment of supply to market demand is, therefore, in the hands of the farmer, and it may be argued with much plausibility that where the control is there must responsibility also lie. The weakest point in the plan is perhaps the fact that when the market price falls below the price stipulated in the contract it becomes actually profitable for the farmer to have a damaged crop still further reduced in yield, since for the differences between the actual yield and the guaranteed yield he is compensated on a basis of a price higher than the one he receives for his actual yield.

In favor of the second plan, which guarantees income rather than yield, it may be said that the affairs of the farmer are adjusted on the basis of an expected income. Furthermore, the guaranteed income is presumably limited to such an extent that the farmer will invariably hope and expect to exceed it. He will, therefore, exercise the same judgment in the adjustment of his various crops to prospective demand as though he bore the entire responsibility for financial results. Objection to this plan is likely to come from the company rather than from the insured.

SUMMARY

The ultimate form of crop-insurance contract in all probability still remains to be devised. The writer ventures, however, by way of summary to emphasize the following principles as fundamental to a sound plan for crop insurance:

1. The insurance must cover only such crop damage as will result in serious financial loss to the farmer. This means that only a reasonable amount of insurance an acre must be written. For establishing such reasonable amount the average yield and price for a series of past years is perhaps the best basis. It means furthermore, that the acreage of a given crop, if not the entire farm, must be insured as a unit and adjustment made on the basis of average yield of such acreage. The total loss of crop on one or a few acres out of a hundred is not a serious loss if the acreage as a whole gives average returns or a substantial part of such average.

2. The insurance must cover any and all hazards which are beyond the farmer's control. Insurance which protects against certain hazards and leaves the insured exposed to total loss from other hazards beyond his control is not real crop insurance.

3. In no case must the insurance protect against loss from carelessness or negligence on the part of the insured. Such protection would involve a moral hazard, the encouragement of which is against the best interest not only of the company but also of the insured and of public welfare in general.

4. The premium, or cost of insurance, must bear a reasonable relationship to the value of the protection that it purchases. This means

that the expense item in the expenditures of the insurance organization must be held to a minor part of the premiums collected; that profits, if the organization operates for profit, must be moderate; and that the bulk of the premiums must be available for the payment of current losses and in favorable years for additions to a reserve for the payment of future losses.

5. The method of adjusting loss must be such that the insured will receive indemnity for crop damage in the amount or on the basis that he is led to expect from the figures indicating the amount of insurance an acre. The company should not profit by a calamity to the farmer in the form of reduced prices for his product.

6. An early adjustment should be provided for in case of total failure of an insured crop, or such an approximation to failure that it would not pay to mature and harvest the crop. The part of the income or yield guaranteed by the contract, which becomes due under such circumstances, should be plainly stated and should not exceed the value of the labor and other costs, including rental, that are actually lost to the insured in connection with the crop.

7. All adjustments involving only partial damage should, so far as possible, be left until after the crop has been harvested and put into marketable form so that quantity and grade can be determined. This makes possible economy in adjustment expenses.

8. Lastly, there must be a certain degree of understanding between the farmers and the company or agency offering the insurance if protection is to be available on truly favorable terms. Crop insurance must be bought on the same principle as fire insurance is purchased, merely as a guaranty against serious loss and not with the expectation of securing an indemnity every two or three years. If the insurance is to be written with the idea that frequent indemnities for minor cases of crop damage are to be paid, it necessarily becomes so expensive that those in greatest need of it can ill afford to buy it. The insured should find some method of helping the organization providing protection to reduce the heavy expense connected with the acquisition of business which now prevails in nearly all lines of insurance, at any rate where the business is conducted on a commercial basis. In some of the European countries, farmers' organizations have applied the principle of collective purchasing to their insurance problems. Perhaps the farmers' organizations of the United States will find some way of solving this problem on a plan consistent with American laws and American conditions.

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